

AD_____

Award Number: DAMD17-97-1-7355

TITLE: Illness Among Persian Gulf War Veterans: Case Validation
Studies

PRINCIPAL INVESTIGATOR: Bradley N. Doebbeling, M.D., M.Sc.

CONTRACTING ORGANIZATION: The University of Iowa
Iowa City, Iowa 52242-1320

REPORT DATE: October 2000

TYPE OF REPORT: Annual

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for public release;
Distribution unlimited

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision unless so designated by other documentation.

DTIC QUALITY INSPECTED 3
20010109 109

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 074-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE October 2000		3. REPORT TYPE AND DATES COVERED Annual (25 Sep 99 - 24 Sep 00)
4. TITLE AND SUBTITLE Illness Among Persian Gulf War Veterans: Case Validation Studies			5. FUNDING NUMBERS DAMD17-97-1-7355	
6. AUTHOR(S) Bradley N. Doebbeling, M.D., M.Sc.				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) The University of Iowa Iowa City, Iowa 52242-1320 E-MAIL: brad-doebbeling@uiowa.edu			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Medical Research and Materiel Command Fort Detrick, Maryland 21702-5012			10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution unlimited				12b. DISTRIBUTION CODE
13. ABSTRACT (Maximum 200 Words) We recently completed a population-based, cross-sectional/cohort telephone survey of 4,886 military personnel to compare the prevalence of self-reported symptoms and illnesses among military personnel either deployed, or eligible but not deployed, during the Gulf War (JAMA, 1997). The proposed series of case-validation and case-control studies nested within our population-based study, should provide an estimate of the true magnitude of the problem. Because of the magnitude of the difference in prevalence between these groups, it is critical to explore and characterize their cognitive deficits, depression, and multisystemic conditions. The primary purpose of the current project is to compare the true rate of confirmed disease among samples of veterans not deployed, with and without these self-reported conditions. Furthermore, we also plan to identify risk factors for each disease outcome of interest including medical and family history, psychological factors, and occupational and environmental exposures for validated illness in a series of nested case-control studies. Year 3 of 4 has just been completed. Through September 2000, 456 subjects have been assessed, with a participation rate of 65%. Recruitment, assessment, and data collection, entry, and validation efforts are ongoing. We are in the process of data editing, database linkage and planning and programming analyses.				
14. SUBJECT TERMS Gulf War, Epidemiology, Risk Factors, Health Status, Validity			15. NUMBER OF PAGES 33	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT Unlimited	

FOREWORD

Opinions, interpretations, conclusions and recommendations are those of the author and are not necessarily endorsed by the U.S. Army.

___ Where copyrighted material is quoted, permission has been obtained to use such material.

___ Where material from documents designated for limited distribution is quoted, permission has been obtained to use the material.

___ Citations of commercial organizations and trade names in this report do not constitute an official Department of Army endorsement or approval of the products or services of these organizations.

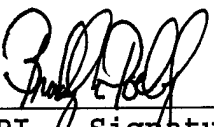
N/A In conducting research using animals, the investigator(s) adhered to the "Guide for the Care and Use of Laboratory Animals," prepared by the Committee on Care and use of Laboratory Animals of the Institute of Laboratory Resources, national Research Council (NIH Publication No. 86-23, Revised 1985).

X For the protection of human subjects, the investigator(s) adhered to policies of applicable Federal Law 45 CFR 46.

N/A In conducting research utilizing recombinant DNA technology, the investigator(s) adhered to current guidelines promulgated by the National Institutes of Health.

N/A In the conduct of research utilizing recombinant DNA, the investigator(s) adhered to the NIH Guidelines for Research Involving Recombinant DNA Molecules.

N/A In the conduct of research involving hazardous organisms, the investigator(s) adhered to the CDC-NIH Guide for Biosafety in Microbiological and Biomedical Laboratories.



PI Signature

10-24-00

Date

**Illness Among Persian Gulf War Veterans: Case Validation Studies,
Grant # DAMD17-97-1-7355**

Introduction

We recently completed a population-based, cross-sectional/cohort telephone survey of 4,886 military personnel to compare the prevalence of self-reported symptoms and illnesses among military personnel either deployed, or eligible but not deployed, during the Gulf War (GW) (JAMA, 1997). The Iowa Gulf War Study, was originally funded by the Centers for Disease Control and Prevention. Compared with non-GW military personnel, GW military personnel reported a significantly higher prevalence of symptoms of a variety of conditions, although the frequency of *a priori* outcomes of depression, cognitive dysfunction, and fibromyalgia were particularly elevated. The validity of these outcomes and the existence of a causal relationship between either military exposures or other risk factors and documented illness for most symptomatic GW veterans remains to be demonstrated.

This study, a series of case-validation and case-control studies nested within the previous population-based cohort study, should provide an estimate of the frequency of clinical illness. Because of the magnitude of the difference in prevalence between these groups, it is critical to explore and characterize the degree to which the groups exhibit cognitive deficits, depression, and fibromyalgia. The primary purpose of the current project is to compare the true rate of confirmed disease among samples of veterans deployed to the Gulf with and without these predefined conditions, versus the true rate of confirmed disease among samples of veterans not deployed, with and without these outcomes. Furthermore, we also plan to identify risk factors for each validated illness outcome of interest, including medical and family history, psychological and social factors, and occupational and environmental exposures in a series of nested case-control studies.

Year 3 of 4 of the grant has just been completed. Through September 2000, 456 subjects have been assessed, with a participation rate of 65%. Recruitment, assessment, data collection, data entry, and validation efforts are ongoing. We are also in the process of data editing, database linkage, and planning and programming of planned analyses.

Past Year's Progress

Data Collection

In the period between October 1999 and September 2000, the end date of the third grant year, 301 additional assessments have been completed. This raises our total number of completed assessments to 456. See Table 1 and Appendix A for more information on these subjects.

Instruments

We made no modifications to the main subject assessment in the past year. In grant year 2 we implemented an open-ended structured interview component to the study, which had been unplanned at the time of the submission of the grant. We have continued to collect structured interview data throughout the past grant year, following completion of the extensive in-person evaluations using structured quantitative assessment tools that have been ongoing. This facet of the study has four basic aims: 1) to understand the experience of illness and health care received by those with medical problems attributed to service in the Gulf; 2) to determine sources of information regarding Gulf War illness; 3) to examine for a possible media effect (or problem with risk communication) on symptom reporting; 4) to better understand subjects' perceptions of Gulf War illness and concerns. In this component subjects are asked a series of structured open-ended questions that assess what measures were taken to prepare troops for the Gulf War, the existence of problems that the individual attributes to service during the period of the Gulf War, and the routes through which subjects get information about illness in Gulf War veterans.

After reviewing transcripts from the initial interviews in several meetings with experts in qualitative research methods (Drs. Toni Tripp-Reimer at University of Iowa and Howard Waitzkin at University of New Mexico), we decided to modify the open-ended structured interview. The main change we made was to restructure the questions to assess subjects' explanatory models of Gulf War illness. "Explanatory model" is a term used in the social sciences that refers to an individual's heuristic for understanding an illness (see Leventhal et al., 1980 and Kleinman et al., 1978). The qualitative interviewer's guide is presented in Appendix B; questions 7 through 14 address the explanatory model concept. These hypotheses and research methods were suggested by our ongoing work on this case-validation study and informal interviews of subjects. Although it is not expected that this additional qualitative data will be analyzed during this grant period, these transcripts should provide an important research resource for exploring these questions with subsequent funding. We expect to apply for subsequent funding to analyze this data using qualitative research methods.

Table 1. Subjects Assessed Through 30 September 2000 (n=456)

	Number	Percent
Deployment status*		
Deployed - GW	342	75.0
Non-deployed - GW	114	25.0
Military status*		
Regular military	128	28.1
National Guard/Reserve	328	71.9
Gender		
Male	415	91.0
Female	41	9.0
Race		
White	442	96.9
Black/other	14	3.1
Branch*		
Army	339	74.3
Air Force	57	12.5
Marines	41	9.0
Navy/Coast Guard	19	4.2
Rank*		
Enlisted	429	94.1
Officer	27	5.9
State of residence		
Iowa	423	92.8
Illinois	13	2.9
Missouri	5	1.1
South Dakota	3	0.7
Minnesota	3	0.7
Nebraska	7	1.5
Wisconsin	2	0.4
Age (at assessment)		
Mean	40.2	
Std. Dev.	9.3	
Minimum	27.3	
Maximum	70.7	

* At time of original telephone survey

Characteristics of Subjects Assessed to Date

Through 30 September 2000, a total of 456 subjects had been assessed, and another 19 had scheduled assessments. Thus far 289 subjects have declined, for a conservative participation rate of 65%. The main reasons given for declining are inability to travel to Iowa City due to the distance and work schedule. We are collecting structured information on reasons for declining to participate. These data are reviewed on an ongoing basis, in order to determine potential interventions to improve recruitment and participation. This data has led us to offer increased reimbursement for travel for those traveling more than 2 hours. We have also developed an Iowa GW study group newsletter to send to all subjects to potentially improve participation (Appendix C).

Among those evaluated to date, there were a total of 342 deployed subjects, and 114 non-deployed subjects completed. Of the 456 subjects assessed, 311 are cases, while the remaining 145 are controls (i.e., did not meet the case definition for cognitive dysfunction, depression, or fibromyalgia at 1995-1996 structured telephone interview). Appendix A presents a breakdown of subjects assessed to date by outcome and deployment status. Table 1 shows descriptive data on these study participants.

Data Analysis/Publication Plans

Data collected as part of the ongoing study to address the primary hypotheses of interest have yet to be presented. Due to concern about influencing enrollment, affecting the blinded assessments, and to avoid interim analyses (which could affect study power), we have decided not to examine differences between cases and controls until subject accrual is complete. However, a number of papers, abstracts and national invited presentations have been developed by members of the research team that examine a variety of Gulf War-related research questions and utilize data from this study population. A list of these works is shown in Appendix D. Other analyses and manuscripts are either in development or being planned.

Personnel

The study is fully staffed. One notable personnel change is the addition of an Assistant Research Scientist, Margaret D. Voelker, PhD, an epidemiologist with specific expertise in symptom epidemiology and health status assessment, who is actively working with Drs. Doebbeling and Woolson to oversee the design and execution of data analyses related to the project. Appendix E shows the personnel associated with the project.

Research Methods

Throughout the past year we have held weekly meetings with key project staff and investigators. These meetings provide a forum for group discussion of a myriad issues related to the study. We have implemented two separate weekly meetings: one to discuss ongoing study considerations (e.g., recruitment and scheduling, data collection, data editing, and a variety of administration issues). The second weekly meeting is dedicated to data analysis issues. In anticipation of shifting from the data collection

phase of the study to the data analysis phase, we have been working to have our databases and data analysis programs in place so that, as the final subjects finish the assessment, we can immediately begin analyzing the data. We plan to test the programs for the planned analyses with a small subset of the data to identify programming and coding problems and further refine the statistical methodology. Work on this front is progressing well, and we anticipate no lag between study phases. We are also planning and conducting a series of analyses that were not outlined in the grant that we feel would be appropriate to complete and submit before the grant is completed.

Laboratory evaluations have been completed as planned on all 197 subjects meeting the case definition for fibromyalgia. Algorithms have been developed to identify subsets of individuals for neurophysiologic and neuromuscular studies based on the results of objective testing during their visit. These algorithms were developed in collaboration with Drs. Thoru Yamada, Mark Ross, Gwendolyn Ford and Joseph Barrash from the Department of Neurology, and Dr. James Torner, our neuroepidemiologist. Identified individuals will then be invited to return for a second visit during year 4. The protocols for these substudies are also under development and review at this time.

We have implemented a new neurophysiologic test that is completed as part of the ongoing initial patient evaluation. Based on input from internal and an external neurologic consultant (Dr. Robert Feldman), we implemented blink reflex testing on a subset of subjects. This relatively noninvasive neurophysiologic test has been used in other studies to quantify conduction latency in subjects who have been exposed to environmental contaminants. In our study, data gathered in this test is designed to assess for and quantify neuropathy (if any) in subjects who may exhibit cognitive dysfunction. This testing evaluates the nerve pathways that carry signals through the facial nerve, trigeminal nerve, and to the brainstem. This test will be conducted in a total of 100 subjects: 10 deployed and 10 nondeployed subjects in all four *a priori* case definition categories that include cognitive dysfunction (CD alone, CD + depression, CD + fibromyalgia, and CD + depression + fibromyalgia), as well as 10 deployed and 10 nondeployed control subjects. To date, 31 blink reflex assessments have been completed.

We are using the facilities of the University of Iowa Health Care's (UIHC) General Clinical Research Center (GCRC) for the assessments. These facilities provide an optimal clinical research setting for the project and allow a "subject-centered" research assessment – instead of transporting subjects to different parts of the hospital to undergo the various facets of the assessment, subjects are centrally located in the GCRC throughout the assessment day. Subjects are provided lunch in the GCRC cafeteria and, if desired, subjects can spend the night in a GCRC inpatient room. In addition, an experienced GCRC nurse obtains vital signs and performs phlebotomy. Appendix F presents a detailed list of instruments and assessments used in the study.

In addition to the primary data that will be generated in this project, we have been working to obtain and link secondary data to assess pre-deployment health status variables, as well as post-deployment data associated with our research subjects. We have been working actively with the Defense Manpower Data Center (DMDC) and the

Center for Health Promotion and Preventive Medicine (CHPPM) to secure access to data relevant to this project. These data will include variables collected at enlistment and throughout an individual's military career. This information will help in a variety of analyses, including the assessment of pre-existing states/conditions, aid in controlling for pre-deployment health status, and as a validity check for a variety of self-reported variables.

Research Subjects

Subjects have been selected from the persons who participated in the Iowa Gulf War study (n=3,695). To limit the pool of subjects to those who would be likely to participate, which involves travel to Iowa City for an in-person evaluation, the pool has been selected to include telephone survey participants whose last known address was in Iowa or a bordering state. The total number of eligible subjects in these states, referred to as "the surrounding region" is 2,464.

Each subject falls into one of eight categories, reflecting the seven possible combinations of the three *a priori* outcomes of interest (Table 2), as well as a category for those who do not meet the criteria for any of the three outcomes. A "case" is an individual who, based on the telephone survey, meets the criteria for one or more of the following *a priori* outcomes: cognitive dysfunction, fibromyalgia, and/or depression. A control subject is an individual who did not meet the definition for any of these three *a priori* outcomes, based on the telephone survey data. Subjects are also categorized reflecting whether or not they were deployed to the Arabian Gulf Theater during the GW era. The resulting number of potential subjects in each group is shown in Table 2.

As Table 2 shows, among the cases, deployed subjects outnumber non-deployed subjects for all but one of the combinations ("depression only" is the exception). To yield maximum precision in the estimate of the false positive rate of symptom reporting, it was decided to sample deployed to non-deployed subjects in an approximate 2 to 1 ratio. Because of the relatively small numbers of non-deployed cases, we are attempting to recruit all the non-deployed cases in any of the seven combinations of outcomes; we have randomly selected twice this number of deployed cases. If fewer than twice as many deployed as non-deployed subjects are available for a given outcome combination, all the deployed subjects for that stratum will be recruited.

There will be two exceptions to the 2 to 1 ratio of deployed to nondeployed. First, we plan to include all 85 of the deployed cases who met the case definition for cognitive dysfunction. Cases who met the definition for cognitive dysfunction, but not the criteria for the other two study conditions are of particular importance in order to optimally characterize this group. Therefore, the decision was made to include the 25 deployed cases with only cognitive dysfunction and who would have been excluded by strict adherence to the planned 2 to 1 ratio. All 58 of the deployed cases who met the *a priori* case definition for both cognitive dysfunction and fibromyalgia have been included. Strict adherence to the 2 to 1 ratio would lead to only 18 deployed cases with this combination of conditions in the sample. In order to fully characterize those with reports

of cognitive dysfunction, it was decided to include all 58 deployed cases who met the case definition for this outcome combination.

Sampling

The original sampling pool of 1064 was intentionally conservative, based on anticipated participation among subjects interviewed by telephone in 1995-96 who would need to be located and brought to Iowa City approximately five years later for in-person evaluation. As in our original study, we planned to draw the sample in stages, based on conservative estimates of effectiveness in subject tracking, locating and recruitment.. We have also found that recruitment of control subjects is more difficult than case subjects. A second-stage sample was planned and implemented after nine months of subject accrual. We analyzed participation by the original sample, based on the original stratification variables included: age, sex, race, military branch, military status, and rank. Based on the distribution of characteristics in the study population, participation rates within strata, and theoretical and epidemiologic considerations, it was decided to stratify the sample on the basis of military branch (army and marines vs. air force and navy/coast guard), regular military vs. guard/reserve, and officer vs. enlisted.

The second-stage sample analysis determined the number of new control subjects to add to the recruitment pool for each of 17 strata comprising the demographic categories above (all potential subjects defined as cases were included in the first-stage sample). For each stratum, we projected the number of individuals who would have to be added to allow the stratum, given the percentage of unavailable subjects from the first-stage sample and projected conversion rate for unavailable subjects, to meet its target number of completed assessments.

Women constitute a small proportion of the overall study population and were not oversampled in the original cohort study, so to maximize statistical power in analyses involving women it was decided to oversample women. Given the small overall number of women in this population (approximately 9%) and the relative difficulty locating them (name changes are the primary challenge), it was decided to include all eligible women in the recruitment pool.

This analysis yielded a total of 266 control subjects to be added to the recruitment pool (139 deployed and 127 nondeployed). The appropriate number of subjects in each stratum was selected randomly. In June 2000, introductory letters were sent to all 266 subjects. The recruitment process has been ongoing for these subjects (as well as for the original first-stage sample).

Cases are also of central importance in order to adequately characterize illness among deployed individuals and identifying their associated risk factors. To maximize precision when addressing these questions, it was decided to sample cases to controls at an approximately 2 to 1 ratio.

Table 2. Total Cases and Controls Available for Assessment, Desired Sample Sizes, and Completed Subjects by *A Priori* Outcome Group Combinations*

	<i>A Priori</i> Outcome Groups	Not Deployed			Deployed			Total		
		Total	Target	Complete	Total	Target	Complete	Total	Target	Complete
Cases	Cognitive Dysfunction, Fibromyalgia, and Depression	28	28	6	82	56	6	110	84	12
	Cognitive Dysfunction and Fibromyalgia	9	9	3	58	58	14	67	67	17
	Cognitive Dysfunction and Depression	32	32	3	65	64	7	97	96	10
	Cognitive Dysfunction only	30	30	4	85	85	20	115	115	24
	Fibromyalgia and Depression	20	20	5	30	30	5	50	50	10
	Fibromyalgia Only	87	87	14	130	130	22	217	217	36
	Depression Only	51	51	6	48	48	9	99	99	15
	Subtotal of cases	257	257	41	498	471	83	755	728	124
Controls	None of the three conditions†	919	100	9	791	200	22	1,710	300	31
Totals		1,176	357	50	1,289	671	105	2,465	1,028	155

*Neurocognitive evaluation to be completed on approximately 100 deployed controls and 100 non-deployed controls.

*Note: data complete as of September 30, 1999, based on geographic location at last known address (time of survey, 1995-96). We have recently obtained updated address information from the Internal Revenue Service through the National Institute of Occupational Safety and Health (NIOSH) with assistance of DoD. This updated address information is expected to provide updated addresses for selected subjects we have been unable to locate and to significantly expand our pool of eligible subjects with a last known address in Iowa or the surrounding states.

As seen in Table 2, this sampling plan would yield a maximum of 257 non-deployed cases, and 471 exposed cases, for a total of 728 cases. Since the participation rate will be less than 100%, we expect approximately 630 of these subjects to participate. The addition of 300 control subjects yields a total of 1,028 subjects for the initial contact pool.

To help ensure comparability across cases and controls, we utilized an adaptive randomization approach. While retaining the element of random selection, this approach yields a somewhat higher probability of inclusion for control subjects, who are similar to subjects in the case group on characteristics likely related to outcome, e.g., age, race, gender, officer/enlisted status, and branch of service. Adaptive randomization procedures adjust the allocation probabilities of subjects as a study progresses (see *Fundamentals of Clinical Trials* by Friedman, Furberg, and DeMets for a discussion of the concept). As we drew our sample of cases, we adjusted the probability of selection of control subjects who were similar with regard to the

demographic and service-related variables listed above. Subjects were not matched on these characteristics, but the probability of being selected for subjects within the control group that were more similar to the cases than other potential controls on certain key stratification variables that were likely confounders was increased.

Subject Locating and Tracking

A major consideration for this study is locating and contacting potential research subjects. Several years have passed since the telephone survey, and a large number of subjects have relocated in the meantime. Once the initial sample for the present study was identified, the following steps were taken to maximize the probability of locating and contacting the largest possible number of selected subjects. First, an introductory letter was sent to subjects' last known address. The letter discussed the current study and instructed subjects on how to contact the project via a toll-free number should they have questions, or if they would like to set up an appointment. Included with this letter was a return postcard to allow subjects to make any necessary corrections to their address and phone number, and to list the best times for telephone contact. If a subject returned the postcard with contact instructions, follow-up was made per those instructions. If no specific callback date was noted, contact was made as soon as possible after receiving the postcard.

In many cases the original introductory letter was returned by the post office as undeliverable. Sometimes a label would be affixed to the envelope listing the subject's current address, and in these cases a new letter was issued to that address. More commonly, a letter was returned with no current address listed. When this happened several Internet locating services were used to try to determine the subject's current address. If this failed to produce any leads, a directory assistance call was placed to the last known city. If no new listings for the subject of interest, a telephone call was placed to the permanent contact person the subject listed in the previous telephone survey.

The permanent contact person has been a valuable tool for locating a large number of subjects. In instances where the permanent contact person is not available, or is not able or willing to provide updated information on a potential subject, the search for the subject has been outsourced to ChoicePoint (formerly Equifax), a credit agency search firm that specializes in locating individuals. Thus far we have sent two batches of names to ChoicePoint, comprising approximately 140 subjects. ChoicePoint was able to supply good contact information for half of these individuals (69 of 140).

Despite the detailed locating algorithms and search strategies we are employing to track down potential subjects, thus far 218 subjects (16% of our current recruitment pool) have not been locatable. To address this, we requested the assistance of the National Institute of Occupational Safety and Health (NIOSH) in using its interagency agreement with Internal Revenue Service (IRS) to perform and address search on individuals who were part of the original Iowa Gulf War sampling frame. We previously used this approach in our original CDC-funded study. Since the current study is funded

by DoD, the approval process to obtain this information was extensive, requiring over 11 months of repeated efforts by us, our project officer (Dr. Drue Barrett) and project staff at DoD.

We have just obtained updated address information from the IRS through the NIOSH, with the invaluable repeated assistance of LtC Michael Leggieri, LtC Rick Riddle, and Maj.Gen. Parker at DoD. This updated address information is expected to expand our pool of available subjects with a last known address in Iowa or the surrounding states. This up-to-date address information should allow us to finally make contact with these subjects, some of whom we have been trying to locate for 18 months or more. We will also review addresses of subjects who were excluded from our pool of potential participants due to their location (i.e., those for whom our records listed a residence outside Iowa or a surrounding state). Any subjects who have relocated to an area that meets our geographic criterion will become part of our pool of potential subjects and recruited, if appropriate, based upon our sampling plans.

Schedule

We have been scheduling subjects at a convenient time for the subject up to several months into the future. Our goal is to schedule 12-15 subjects per week, although it has become increasingly difficult to reach this level due to an increasingly smaller pool of potential subjects. For example, we have averaged 7 assessments per week in August-September 2000.

Several steps have been taken to boost recruitment. First, the aforementioned IRS address search will allow us to resume active recruitment of the over 200 subjects that have heretofore been unlocatable. It is also expected that more recent address information will identify eligible subjects that have moved back to Iowa or the Midwest since the time of the telephone interview in 1995-96 that may potentially expand our pool of eligible subjects.

Second, we have developed a newsletter to distribute to participants in the original telephone survey (see Appendix C). The newsletter provides background on the current study, includes comments from study participants regarding their satisfaction with the current evaluation, and demonstrates our research productivity and participation on national committees and in national presentations with the data being provided. We expect this newsletter will help inform potential subjects about the study, enhance subject tracking and may generate some interest among potential subjects.

Third, we have begun offering one to two Saturday appointment dates per month. This will help secure the participation of subjects who are interested in participating but unable to schedule an appointment during the week due to employment considerations. This measure may be particularly important in recruiting control subjects who find it difficult to travel to Iowa City for a full one-day evaluation while working.

Related to this, we are in the process of recontacting subjects who expressed an interest in participating but were unable to schedule an appointment at the time of

contact. This is routinely done for subjects who are unable to schedule an appointment at the time we call them, but the availability of Saturday appointments should allow us to convert a contingent of subjects who declined based on their unavailability during the week.

Our goal is to maintain an average of at least 12 assessments per week (2.2 per day) – maintaining this rate would lead to completion of the subject accrual phase in June 2001.

Data Management

Study data are being double entered on an ongoing basis. A number of steps have been taken to ensure data accuracy and quality. First, all case report forms and questionnaires are reviewed by research personnel prior to the subject leaving for the day. Second, all data are being entered on electronic forms programmed in Access that have built-in range and consistency checks. For example, if a specific item only has a valid range of 1 through 5, the form is set up to accept input only within this range. The forms are also designed to bear a close resemblance to the original instruments from which the data are coded. To help ensure the accuracy of data entry, two different data entry personnel are entering the all the data separately. The second entry is compared to the first, and any discrepancies are resolved. Discrepancies that cannot be easily resolved, i.e., that are due to an ambiguous response by the subject or something else beyond a simple keystroke error, are reviewed by the study coordinator and, if necessary, by the principal investigator. If the response is still unclear, the study coordinator will contact the subject for clarification.

Data entry has been in progress since the subject assessment phase of the project began. To date, data for each assessed subject have been entered once, and the second entry has been completed for all but approximately 30 subjects. We have found a very low rate of data entry errors, which have reduced to a negligible rate over time.

Conclusion

The project is fully staffed and subject accrual and assessment are ongoing. Recruitment and assessment processes are being constantly assessed for opportunities to increase efficiency and effectiveness. We are striving to complete the subject accrual phase in spring 2001. In the meantime we are planning data analyses in order to efficiently execute the study's data analysis phase. Data entry is keeping pace with completed assessments, and analysis programs are being written and tested in an effort to expedite the analysis phase. Also, in an effort to maximize the efficient use of the rich database that is being developed as part of this study, the research team will work to develop interim analyses that are leading to papers and presentations of interest even before subject accrual is complete. We have also been productive in presenting and publishing results of our research in important scientific journals and at national meetings.

We expect to likely request a one-year no cost extension to the project to allow adequate time for implementing data analyses, review and checking of the results, preparation of the final report and summary manuscripts.

Appendix A. Completed Assessments Broken Down by *A Priori* Outcome and Deployment Status (Assessments completed through 9/30/99)

Cognitive Dysfunction

	Deployed	Not Deployed	
Symptomatic ¹	138	26	
Not Symptomatic	204	88	
	342	114	456

Depression

	Deployed	Not Deployed	
Symptomatic	103	39	
Not Symptomatic	239	75	
	342	114	456

Fibromyalgia

	Deployed	Not Deployed	
Symptomatic	146	51	
Not Symptomatic	196	63	
	342	114	456

By Illness Combinations

	CD	Dep	Fibro	CD, Dep	CD, Fibro	Dep, Fibro	CD, Dep, Fibro	No Illness	Total
Deployed	41	24	57	24	34	16	39	107	342
Not Deployed	5	13	28	7	4	9	10	38	114
Total	46	37	85	31	38	25	49	145	456

¹ For each outcome, refers to self-reported symptomatology based on the 1995-96 telephone survey

Appendix B: Structured Open-Ended Interviewer's Guide

OPEN-ENDED QUESTIONS ON GWS AND INFORMATION SOURCES

Next, I have several questions for you to respond to in your own words. This is a chance for you to give some comments and opinions on issues surrounding the Gulf War. If there are any questions that you don't want to answer or don't have an answer for, we can skip to the next one. Do you have any questions before we start? I am going to begin recording now so that we can transcribe your responses. As always, your name will not be associated with your answers.

(1) Can you describe any health problems that you are experiencing?

**IF NONE→
IF YES→**

**SKIP TO 3
CONTINUE**

(1a) When did you begin experiencing these problems?

(2) Do you associate any of your health problems with your military service during ODS/DS (service between 8/2/90 and 7/31/91)?
[IF YES]: Which ones?

(3) Are there any past health problems that you associate with your military service during ODS/DS?

**IF NO CURRENT OR PAST HEALTH PROBLEMS DUE TO GW→
IF CURRENT HEALTH PROBLEMS DUE TO GW ONLY→
IF ANY PAST HEALTH PROBLEMS DUE TO GW→**

**SKIP TO 7
SKIP TO 4
CONTINUE**

(3a) When did you begin experiencing these problems?

(4) How is it that these health problems are associated with your ODS/DS era military service? [PROBE FOR EXPOSURES/CAUSATION]

(5) What impact have these health problems had on:

(5a) Your usual activities?

(5b) Your personal relationships?

(5c) Your work?

(6) Did you seek medical attention for these health problems?

[IF YES]: Can you describe the reactions and the care you received from HCWs?

(7) Have you heard of an illness or syndrome associated with service in the Gulf War?

**IF NO→
IF YES→**

**SKIP TO 7b
CONTINUE**

(7a) What is it called? [SKIP TO 7c]

(7b) Have you heard of Gulf War Syndrome? [IF NO→SKIP TO 17]

(7c) What do you think about that?

I have a few questions related to this term in general. [GENERAL EXPLANATORY MODEL]
[IN 8-16, USE SUBJECT'S OWN TERM FROM (7a), UNLESS NOT GIVEN, THEN USE GWS]

(8) What type of health problems or symptoms are associated with the term, [GWS]?

(9) What causes [GWS]?

[IF SPECIFIC CAUSES/EXPOSURE: PROBE: HOW DOES THIS EXPOSURE TIE
WITH THE ASSOCIATED HEALTH PROBLEMS]

(10) How serious is it?

(11) How common is it?

(12) How widespread is it?

(13) What can be done about it? [PROBE FOR TREATMENT]

(14) Aside from health problems, what difficulties does a person with [GWS] experience?

Now I want to focus on how [GWS] may affect you personally. [SPECIFIC EXP. MODEL]

(15) Do you think you have [GWS]?

IF NO→

SKIP TO 13

IF YES→

CONTINUE

(15a) Please describe it.

(15b) What caused it?

(15c) When did it start?

(15d) Which of your symptoms or health problems do you (he/she) associate with
[GWS]?

(15e) How does it work?

(15f) What treatment do you think would help?

(15g) Are you (he/she) receiving that treatment?

(15h) How long will this last?

(15i) How serious is this?

(15j) What difficulties has GWS caused in your (his/her) life?

(15k) What other worries do you (he/she) have about it?

(16) Do you know anyone else who has it?

IF 12=NO, 13=NO→

SKIP TO 17

IF 12=NO, 13=YES→

RETURN TO 15a-15k

IF 12=YES, 13=YES→

CONTINUE

(16a) Could you describe his/her experience with [GWS]?
[PROBE FOR SIMILARITIES/DIFFERENCES]

Next, I have a few more general questions.

[SOURCES OF INFORMATION & PSYCHOGENIC ILLNESS RISK FACTORS]

- (17) What kind of potential health risks were you told about prior to deployment?
- (18) How was your unit prepared before possible deployment for health protection and environmental hazards in the Gulf War?
- (19) Can you tell me about any vaccines you received?
[PROBE FOR WHAT, WHEN, WHERE, ANTHRAX VACCINE]
- (20) What risks (if any) do you believe are associated with the use of vaccines?
- (21) Please explain any personal or work-related difficulties you experienced upon return home from military service after the Gulf War.
[PROBE: ANY READJUSTMENT PROBLEMS]
- (22) Tell me about official information you received after ODS/DS about potential health risks and health consequences of military service?
- (23) Can you describe how you first became aware of medical problems experienced by Gulf War veterans? (When was that?)
- (24) Have you seen anyone (else) with Gulf War medical problems?
[IF YES:] Tell me about the circumstances in which you saw them [SAW THEM IN PERSON?]
- (25) Overall, what have been your sources of information about it?
- (26) How closely do you follow stories about Gulf War illness?
- (27) What is your most important information source about GW issues – what do you rely on?
- (28) What do you think about the way information about Gulf War illness has been presented to the public?
- (29) Please comment on how the government and military handled Gulf War illness and related issues - Do you have suggestions to help in future deployments?

Thank you. Those are all of my questions. Do you have any further comments?

Appendix C: Newsletter

Table of Contents

Foreward	iii
Introduction	1
Past Year's Progress	1
Data Collection.....	1
Instruments	2
Characteristics of Subjects Assessed to Date.....	4
Data Analysis/Publication Plans.....	4
Personnel.....	4
Research Methods.....	4
Research Subjects.....	6
Sampling	7
Subject Locating and Tracking.....	9
Schedule	10
Data Management	11
Conclusions	11

List of Tables

Table 1. Subjects Assessed (through 30 September 1999).....	3
Table 2. Cases and Controls: Total Available for Assessment, Desired Sample Sizes, and Completed Subjects (as of 30 September 1999) by <i>A Priori</i> Outcome Group Combinations	8

List of Appendices

Appendix A. Completed Assessments Broken Down by <i>A Priori</i> Outcome and Deployment Status (Assessments completed through 30 September 1999)	
Appendix B. Structured Open-Ended Interviewer's Guide	
Appendix C. Newsletter.....	
Appendix D. Recent Manuscripts and Presentations	
Appendix E. Study Personnel	
Appendix F. Data Collection Instruments.....	
Appendix G. Eligible Subjects (based on the study's three <i>a priori</i> outcomes)	

Update



"Perhaps the strongest study on Gulf War Veterans' experience of symptoms related to deployment in the Gulf is the 'Iowa Study,' a population-based study of all military personnel who listed Iowa as the home of record at enlistment."

--Institute of Medicine Committee on Measuring the Health of Gulf War Veterans, 1999

Illness Among Persian Gulf War Veterans: Case Validation Studies

In 1995 and 1996, researchers at the University of Iowa, Iowa State University and the Iowa Department of Public Health conducted a study funded by the Centers for Disease Control and Prevention (CDC) to assess the frequency of illness among Persian Gulf War Veterans. During the course of the study, 3,695 Iowa veterans were interviewed by telephone and asked questions about their symptom experience, wartime exposures, and specific illnesses. The results of the study demonstrate that Persian Gulf veterans experienced symptoms of multiple conditions more frequently than nondeployed veterans. These results have helped PGW veterans across the country receive compensation from the VA.

The Iowa Study data generated a great deal of interest from medical, scientific and military populations. Results from the study published in the *Journal of the American Medical Association (JAMA)* in January 1997 were among the first published studies to demonstrate an increased frequency of health problems among the deployed. Project investigators have published further articles since that time in the *American Journal of Medicine*, *Archives of Internal Medicine*, and the *Journal of Occupational and Environmental Medicine (JOEM)*. Project investigators have been invited to present the results at numerous national medical conferences and to serve on related committees. The Iowa Study also won notable praise from the Institute of Medicine in its 1999 book, *Gulf War Veterans: Measuring Health*. In the future, the project investigators will continue to ana-

lyze the phone study data and report their findings.

Bradley Doebbeling, MD, MSc was recently awarded a \$1.5 million grant to continue the research into Gulf War Veterans' health with a study entitled, "Illness Among Persian Gulf War Veterans: Case Validation Studies." The project was pilot tested with the help of members of the Iowa National Guard and underway by March of 1999. Since then, over 450 veterans have come to the University of Iowa Hospitals and Clinics in Iowa City to participate in the project. An appointment lasts 5-8 hours and includes a physical examination, neurologic and laboratory testing, interviews and risk factor assessment. Over the next several months, the Iowa Persian Gulf War Study will continue to recruit veterans; they hope to recruit 900 participants by the end of the study in 2001.

Response Rate

The response rate is the percentage of eligible people who actually participate in a study. In order to gather the most accurate information, it is important for researchers to get the highest possible response rate for their studies. The overall response rate for the Iowa Study was 76% of the eligible veterans, and 91% of those who could be located. The Iowa Study response rate is among the highest for all studies concerned with the health of Persian Gulf veterans.

--Institute of Medicine, 1999

Dr. John Feussner testifies before Congressional Board

On April 4, 2000, the Presidential Special Oversight Board for Department of Defense Investigations of Gulf War Chemical and Biological Incidents held a public hearing in Washington DC. Dr. John Feussner, the chair of the Persian Gulf Veterans Coordinating Boards Research Working Group, testified on the status of Gulf War research. He stressed the importance of longitudinal studies that allow researchers to look at changes in health status for the same individuals and groups over time. Investigators on the Iowa Study collected data in 1996, are currently collecting data from the same veterans, and may also conduct a follow-up telephone study. Dr. Feussner told the Board, "Again, what you really want to know is the longitudinal nature of the health status, and the best data that we have again comes from the Iowa Study. We will have information 96, 99 and into the future."

Sources of Information

DoD Gulf War Veterans Hotline:

1-800-796-9699

VA Gulf War Information Helpline:

1-800-PGW-VETS

GulfLINK Website:

www.gulflink.osd.mil

Public Advisory Committee

A unique aspect of the Iowa Study was the formation of a Public Advisory Committee (PAC). The study investigators invited representatives from outside agencies and groups to join the PAC. The committee served as a liaison between the researchers and participating veterans and veteran groups. They provided valuable input throughout the planning stages of the study and assisted in recruiting participants.

Cochairs:

Tim Striley and John Kelly Iowa Department of Public Health

Committee Members:

Oscar Ballard	Paralyzed Vets of America
Randy Brown	Commission of Veterans Affairs
Dennis W. Gooden	Disabled American Veterans
Mark Heiderscheit	Veterans Affairs Medial Center
Richard Hodges	Veterans Affairs Medial Center
M. Terry Lipovac	Veterans of Foreign Wars
Lydia Siefken	AmVets
Robert O. Steben	AmVets
Phillip Talboy	Centers for Disease Control & Prevention
Annie Tuttle	Veterans Affairs Medial Center
Tully Walker	Veterans Affairs Medial Center
Larry Wisnosky	Department of Veterans Affairs
Colonel Mark Zirkelbach	Iowa National Guard, Camp Dodge

Iowa Persian Gulf Research Project: Follow-up Study on Asthma

Several members of the Iowa Persian Gulf Study Group are currently conducting a follow-up to the Iowa Study entitled, "Iowa Persian Gulf Research Project: Follow-up Study on Asthma." Through this research, the doctors hope to learn more about asthma reported by Persian Gulf War veterans. David A. Schwartz, MD, MPH, Bradley N. Doebbeling, MD, MSc, and Joel Kline, MD began the study in the spring of 1998. Approximately 70 veterans have participated thus far; they hope to meet with 200 veterans before the end of the study. Study participants travel to the University of Iowa Hospitals and Clinics for an assessment which includes a physical examination, lung function tests and questionnaires on health status, occupational/military exposures and emotional health. For further information, please contact the study coordinators, Deb Pfab and Sandy Reed, at 1-800-296-4916.

Case Validation Study Group

Principal Investigator:

Bradley N. Doebbeling, MD, MSc

Study Group:

Megan Adams, BS, BA
Edward Aul, MD
Joseph Barrash, PhD
Donald W. Black, MD, MS
Caroline Carney Doebbeling, MD, MS
Arthur Hartz, MD, PhD
John Holman, MA
Kenneth G. Saag, MD, MSc
James C. Torner, PhD
Margaret D. Voelker, PhD
David Watson, PhD
Robert F. Woolson, PhD
Thoru Yamada, MD

Iowa Persian Gulf Study Group

Principal Investigator:

David A. Schwartz, MD, MPH

Co-principal Investigators:

Bradley N. Doebbeling, MD, MSc
James A. Merchant, MD, DrPH

Principal CDC Investigator:

Drue H. Barrett, PhD

Internal Study Group:

Donald W. Black, MD
Leon F. Burmeister, PhD
William R. Clarke, PhD
Kenneth H. Falter, PhD
Daniel B. Hall, PhD
Martha F. Jones, MA
Kenneth G. Saag, MD
Terri L. Snyders, MA
Peter S. Thorne, PhD
James C. Torner, PhD
Robert F. Woolson, PhD

Coinvestigators:

Zuhair K. Ballas, MD
Joseph Barrash, PhD
Thomas B. Casale, MD
Elizabeth Chrischilles, PhD
Henry Falk, MD, MPH
Michael D. Hansen, MS
Roger G. Kathol, MD
John R. Kelly
Bruce M. Pfohl, MD
Warren W. Piette, MD
Patricia Quinlisk, MD, MPH
James E. Rohrer, PhD
Nancy L. Sprince, MD, MPH
Phillip M. Talboy
Craig Zwerling, MD, PhD, MPH

Researchers present findings to and serve on National Gulf War Research Committees

Since completion of the original telephone survey, researchers have been actively sharing results with members of military, scientific and medical communities.

Dr. Brad Doebbeling has repeatedly been an invited participant in the Annual Meetings of Federal Investigators in Gulf War Illnesses and will present several invited

talks at the 2001 meeting. He has also presented Iowa Study data to groups at the Institute of Medicine, Department of Veterans Affairs and the Department of Defense. Dr. Doebbeling serves on the Federal Investigators in Gulf War Illnesses Planning Committee.

Dr. Donald Black and Dr. Kenneth Saag

are currently serving on an Institute of Medicine Committee charged with "Identifying effective treatments in Persian Gulf War veterans."

Researchers from the Iowa Persian Gulf Study Group will continue to provide and present updates and findings from the current follow-up study.

Iowa Persian Gulf Study Group Publications

Selected journal articles published from the Iowa Study data along with key points

The Iowa Persian Gulf Study Group. Self-reported Illness and Health Status Among Gulf War Veterans: a population-based study. *JAMA*. 1997;277:238-245.

- Military personnel who participated in the PGW have a higher self-reported prevalence of medical and psychiatric conditions than military personnel who were not deployed to the Persian Gulf.
- Symptoms reported with significantly higher prevalence include: chronic fatigue, cognitive dysfunction, bronchitis, asthma, fibromyalgia, alcohol abuse, post-traumatic stress disorder, anxiety, depression and sexual discomfort.
- The findings establish the need to further investigate the potential consequences of an increased prevalence of multiple medical and psychiatric conditions in populations of military personnel deployed to the Persian Gulf.
- This study was a key addition to the Gulf War research because it was population-based, included an assessment of the health of a control population, included discharged, National Guardsmen, reservists and women.

Black DW, Doebbeling BN, Voelker MD, et al. Multiple Chemical Sensitivity Syndrome: Symptom Prevalence and Risk Factors in a Military Population. *Arch Intern Med*. 2000;160:1169-1176.

- Multiple chemical sensitivity (MCS) is a controversial diagnosis that has been attributed to an extreme sensitivity to low concentrations of chemicals tolerated by most people.
- Veterans of the PGW reported a significantly higher prevalence of symptoms suggestive of MCS than did non-PGW military personnel (5.4% vs 2.6%).
- Several factors other than deployment to the Persian Gulf were associated with meeting the criteria for MCS including predeployment health conditions.

Black DW, Doebbeling BN, Voelker MD, et al. Quality of Life and Health-Services Utilization in a Population-Based Sample of Military Personnel Reporting Multiple Chemical Sensitivities. *JOEM*. 1999;41:928-933.

- 169 participants in the Iowa Study (4.6%) reported symptoms suggestive of MCS.
- Those participants reported substantially more physical, emotional, social and occupational impairment as well as decreased health related quality of life and increased health services utilization.

Doebbeling BN, Clarke WR, Watson D, et al. Is There a Persian Gulf War Syndrome? Results from a Large, Population-based Study. *Am J Med*. 2000;108:695-704..

- Half of the deployed veterans in the Iowa Study reported health problems that they attributed to military service in 1990-1991 compared to 14% of the nondeployed veterans.
- The patterns of symptoms were nearly identical in the two groups which suggests that the health complaints of Gulf War veterans are similar to those of the general military population.

What are people saying?

At the end of their appointments, participants are invited to complete an anonymous comment sheet. Here are the thoughts of some past participants:

"Very excellent program. Very well organized. I was treated very well."

"This is time well spent."

"I liked the ordered way in which the tests were administered. Staff were very professional. Enjoyed meeting other volunteers for the study to talk about our Persian Gulf experiences."

"It is reassuring to know that all of my information is confidential."

"Thank you for the opportunity to participate in this study. I hope it is beneficial to all of the veterans involved. All of the staff and personnel involved were very professional and courteous."

"I believe you have an outstanding program and also have an outstanding staff to carry out the program."

"Great!"

"The day was well planned, and I didn't have to sit around bored for any length of time."

99% of participants agreed or strongly agreed that they were treated respectfully during their visit.

98% of participants agreed or strongly agreed that they were fairly compensated for their participation.

96% of participants agreed or strongly agreed that the visit was well-planned.

93% of participants agreed or strongly agreed that this is a worthwhile study.

"Everyone was very helpful, and they make me feel proud to be a part of this program."

"(You) did a real good job of explaining everything and making my visit go smoothly."

"Thank you for caring for the well being of war veterans and for being there, for supporting the efforts of the soldiers and their families."

"I definitely did not waste my time by participating in this study."

"Well planned. Staff was very helpful and adjusted quickly to anything that unbalanced the time table to keep the day going well."

"It was a fun and interesting day."

If you would like more information on the follow-up study, call:

1-877-PER-GULF

Papers recently published or in press:

- Sadler, AG, Booth, BM, Nielson, D, and Doebbeling, BN. Health-related Consequences of Physical and Sexual Violence: Women in the Military. *Obstet. Gyn.* 96(3):473-480, 2000.
- Zwerling, C, Torner, JC, Clarke, WR, Voelker, MD, Doebbeling, BN, Barrett, DH, Merchant, JA, Woolson, RF, and Schwartz, DA. Self-Reported Injuries Among Gulf War Veterans: A Population-based Study. *Public Health Rep.* (In press), 2000.

Papers submitted or in preparation:

- Barrett, DH, Gray, GC, Doebbeling, BN, Clauw, D and Reeves, WC. The Prevalence of Symptoms and Symptom-Based Conditions among Gulf War Veterans. (Submitted), 2000.
- Carney Doebbeling, C, Sampson, T, Voelker, M, Woolson, R, Allen, J, Schwartz, DA, and Doebbeling, BN. Gender differences in medical symptoms and health status in a population-based sample of Persian Gulf military personnel (In preparation), 2000.
- Gerrity, TR, Heller, J, Brix, K, and Doebbeling, BN. The Kuwait Oil Well Fires: Exposure and Health Effects. (Submitted), 2000.
- Sadler, AG, Booth, BM, Cook, BL, Torner, JC, and Doebbeling, BN. The Military Environment: Risk Factors for Women's Nonfatal Physical Assaults. (Submitted), 2000.
- Sadler, AG, Booth, BM, Cook, BL, and Doebbeling, BN. The Military Environment: Factors Associated with Women's Risk of Rape. (Submitted), 2000.
- Voelker, MD, Saag, KG, Schwartz, DA, Chrischilles, E, Clark, WR, Woolson, RF, and Doebbeling, BN. Health-related Quality of Life among Gulf War Era Veterans. (Submitted), 2000.

Recent and Upcoming Invited Presentations:

- Barrash, J. "A Population-Based Study of Cognitive Difficulties in Gulf War Era Veterans: Neuropsychological Findings in Military Personnel in Iowa," Invited Plenary Speaker, 2001 Research Conference on Gulf War Veterans' Illnesses, "*Illnesses in Gulf War Veterans: A Decade of Scientific Research*," Washington, D.C., January 24-26, 2001.
- Doebbeling, BN. "Dissemination Workshop: Gulf War Veterans: Measuring Health and National Center for Military Deployment Health Research," Invited Panel Member, Institute of Medicine, National Academy of Sciences, Washington, D.C., December 16-17, 1999.
- Doebbeling, BN. "Health-Related Quality of Life in Gulf War Veterans," Invited Presentation, Persian Gulf Veterans Coordinating Board, Research Working Group, Washington, D.C., April 27, 2000.
- Doebbeling, B.N. "The Iowa Cohort Study," in "Ongoing Longitudinal Follow-up Studies of Gulf War Veterans," Invited Plenary Speaker, 2001 Research Conference on Gulf War Veterans' Illnesses, "*Illnesses in Gulf War Veterans: A Decade of Scientific Research*," Washington, D.C., January 24-26, 2001.
- Doebbeling, BN. "The Iowa Study Syndrome Analysis" in "Is There a Gulf War Syndrome?: Alternate Approaches to Case-Definition," Invited Plenary Speaker, 2001 Research Conference on Gulf War Veterans' Illnesses, "*Illnesses in Gulf War Veterans: A Decade of Scientific Research*," Washington, D.C., January 24-26, 2001.

Appendix D. Recent Manuscripts and Presentations

Peer-Reviewed Papers Published or In Press:

Black, D.W., Doebbeling, B.N., Voelker, M.D., Clarke, W.R., Woolson, R.F., Barrett, D.H., and Schwartz, D.A. Quality of life and health service utilization in a population-based sample of military personnel reporting multiple chemical sensitivities. *J. Occup. Environ. Med.* 41(10):928-933, 1999.

Black, D.W., Doebbeling, B.N., Voelker, M.D., Clarke, W.R., Woolson, R.F., Barrett, D.H., and Schwartz, D.A. Multiple Chemical Sensitivity Syndrome: Symptom Prevalence and Risk Factors in a Military Population. *Arch. Intern. Med.* 160:1169-1176, 2000.

Doebbeling, B.N., Clarke, W.R., Watson, D., Torner, J.C., Woolson, R.F., Voelker, M.D., Barrett, D.H., and Schwartz, D.A. Is There a Persian Gulf War Syndrome? Evidence from a Large, Population-based Survey of Veterans and Nondeployed Controls. *Am. J. Med.* 108(9):695-704, 2000.

Sadler, A.G., Booth, B.M., Nielson, D., and Doebbeling, B.N. Health-related Consequences of Physical and Sexual Violence: Women in the Military. *Obstet. Gynecol.* 96:473-480, 2000.

Zwerling, C., Torner, J.C., Clarke, W.R., Voelker, M.D., Doebbeling, B.N., Barrett, D.H., Merchant, J.A., Woolson, R.F., and Schwartz, D.A. Self-Reported Injuries Among Gulf War Veterans: A Population-based Study. *Public Health Rep.* (In press), 2000.

Gorbatenko-Roth, K.G., Levin, I.P., Altmaier, E.M., and Doebbeling, B.N. Accuracy of Health-related Quality of Life Assessment: Do Patient's Preferences for Domain Functioning Need to be Incorporated into the Measurement Process? *Health Psychol.* (In press), 2000.

Reviews, Editorials, Letters to the Editor:

Doebbeling, B.N., Clarke, W.R., Watson, D., Torner, J.C., Woolson, R.F., Voelker, M.D., Barrett, D.H., and Schwartz, D.A. The Authors Reply: Alternate Hypotheses for Gulf War Illness and Peer-reviewed Evidence. *Am. J. Med.* 108 (In press), 2000.

Abstracts:

Doebbeling, B.N., Rohrer, J.E., Woolson, R.F., Torner, J.C., Saag, K.G., Merchant, J.A., Bentler, S., and Schwartz, D.A.: Health Services Utilization among Persian Gulf War and Activated Non-deployed Veterans. Annual Meeting of the American Public Health Association, Indianapolis, IN, p. 123, November 11, 1997.

Doebbeling, B.N., Woolson, R.F., Torner, J.C., Merchant, J.A., Barrett, D., Polzer, J.P., and Schwartz, D.A.: Self-reported Illness Following Service in the Persian Gulf: Multiple Medical Conditions. Annual Meeting of the American Public Health Association, Indianapolis, IN, p.5, November 10, 1997.

Voelker, M., Doebbeling, B.N.: Predictors of Mental Health Service Utilization Among Persian Gulf War Veterans. Abstracts of the 1997 International Conference on Health Policy Research: Methodologic Issues in Health Services and Outcomes Research. Boston, MA, December 1997.

Zwerling, C., Torner, J.C., Clarke, W.R., Voelker, M.D., Doebbeling, B.N., Barrett, D.H., Merchant, J.A., Woolson, R.F., and Schwartz, D.A.: Traumatic Injury Among Gulf War Era Veterans: An Analysis of the Iowa Persian Gulf War Study. 31st Annual Meeting of the Society for Epidemiologic Research, Chicago, IL, June 24-26, 1998.

Carney, C.C., Allen, J., Clarke W; Schwartz, D.A., Woolson, R., Barrett, D., and Doebbeling, B.N.: Gender Differences in Health Status in a Population-Based Sample of Military Personnel Deployed or Activated, Not Deployed to the Persian Gulf. 45th Annual Meeting of the Academy of Psychosomatic Medicine, Psychosomatics, November 1998.

Voelker, M.D., Torner, J., Woolson, R., and Doebbeling, B.N. Symptomatology Associated With Self-Perceived Health Decline among Gulf War Veterans and Era Controls. Abstracts of the Federal Investigators Annual Meeting on Persian Gulf War Illness, Washington, DC, June 23-25, 1999.

Simms, L. J., & Watson, D. Exploratory Factor Analysis of PTSD Symptoms in Two Military Samples. Abstracts of the 107th Annual Convention of the American Psychological Association, Boston, MA, August, 1999.

Sadler, A.G., Booth, B.M., Cooke, B.L., and Doebbeling, B.N. Military Occupational and Environmental Risk Factors for Rape: An Assessment by Era of Service. Abstracts of the 4th Federal Investigators Annual Meeting on Persian Gulf War Illness Research, Washington, DC, June 23-25, 1999.

Sadler A., Booth, B., Cook, B., and Doebbeling, B.N. Women's Military Environmental Risk Factors for Violence: Assessment by Era. Abstracts of the 15th Annual International Society for Traumatic Stress Studies Meeting, Miami, FL, November 14-17, 1999.

Sadler A., Booth, B., Cook, B., and Doebbeling, B.N. Repeated Violence Against Women During Military Service: Effects on Health Status and Outpatient Medical Utilization. Abstracts of the Community Prevention Research in Women's Health Conference, NIH, Bethesda, MD, Oct. 26-27, 2000.

Sadler A., Booth, B., Cook, B., and Doebbeling, B.N. The Military Environment: Risk Factors For Women's Non-Fatal Physical Assaults. Abstracts of the Community Prevention Research in Women's Health Conference, NIH, Bethesda, MD, Oct. 26-27, 2000.

Sadler A., Booth, B., Cook, B., and Doebbeling, B.N. The Military Environment: Risk Factors for Women's Non-Fatal Physical Assaults. VA Health Services Research 19th Annual Meeting, Washington, DC, (Submitted), February 14-16, 2001.

Sadler A., Booth, B., Cook, B., and Doebbeling, B.N. Repeated Violence Against Women During Military Service: Effects on Health Status, Outpatient Medical Utilization and Access to Care. VA Health Services Research 19th Annual Meeting, Washington, DC, (Submitted), February 14-16, 2001.

Other: Exhibits, Films, Tapes, Special Presentations:

Doebbeling, B.N. "The Iowa Persian Gulf Study: An Update," Institute of Medicine/National Academy of Sciences, Committee on the Health Effects Associated with Exposures Experienced During the Gulf War, Georgetown, June 14, 1999.

Doebbeling, B.N. "Case Definition Panel Discussion" Scientific Discussant, 4th Annual Meeting of Federal Investigators on Gulf War Illness, Washington, DC, June 23, 1999.

Doebbeling, B.N. "Veterans' Forum: A Roundtable Discussion," Scientific Discussant, 4th Annual Meeting of Federal Investigators on Gulf War Illness, Washington, DC, June 24, 1999.

Doebbeling, B.N., Voelker, M.D. "Illness Among Persian Gulf War Veterans", Invited Presentation, Iowa County Commission on Veterans' Affairs, Des Moines, Iowa, October 13, 1999.

Doebbeling, B.N. "Dissemination Workshop: Gulf War Veterans: Measuring Health and National Center for Military Deployment Health Research", Invited Panel Member, Institute of Medicine, National Academy of Sciences, Washington, D.C., December 16-17, 1999.

Doebbeling, B.N. "Health-Related Quality of Life in Gulf War Veterans," Invited Presentation, Persian Gulf Veterans Coordinating Board, Research Working Group, Washington, D.C., April 27, 2000.

Doebbeling, B.N. "The Iowa Cohort Study," in "Ongoing Longitudinal Follow-up Studies of Gulf War Veterans", Invited Plenary Speaker, 2001 Research Conference on Gulf War Veterans' Illnesses, *"Illnesses in Gulf War Veterans: A Decade of Scientific Research"*, Washington, D.C., January 24-26, 2001.

Doebbeling, B.N. "The Iowa Study Syndrome Analysis" in "Is There a Gulf War Syndrome?: Alternate Approaches to Case-Definition", Invited Plenary Speaker, 2001 Research Conference on Gulf War Veterans' Illnesses, *"Illnesses in Gulf War Veterans: A Decade of Scientific Research"*, Washington, D.C., January 24-26, 2001.

Barrash, J. "Results of Neuropsychological Research of Gulf War Veterans", Invited Plenary Speaker, 2001 Research Conference on Gulf War Veterans' Illnesses, *"Illnesses in Gulf War Veterans: A Decade of Scientific Research"*, Washington, D.C., January 24-26, 2001.

Papers Submitted:

Voelker, M.D., Saag, K.G., Schwartz, D.A., Chrischilles, E., Clarke, W.R., Woolson, R.F., and Doebbeling, B.N. Health-related Quality of Life among Gulf War Era Veterans. (Submitted), 2000.

Barrett, D.H., Gray, G.C., Doebbeling, B.N., Clauw, D. and Reeves, W.C. The Prevalence of Symptoms and Symptom-Based Conditions among Gulf War Veterans. In: J.R. Feussner (ed), *Illnesses among Gulf War Veterans: A Decade of Scientific Research*. Ann. Intern. Med. (Submitted), 2000.

Gerrity, T.R., Heller, J., Brix, K., and Doebbeling, B.N. The Kuwait Oil Well Fires: Exposure and Health Effects. In: J.R. Feussner (ed), *Illnesses among Gulf War Veterans: A Decade of Scientific Research*. Ann. Intern. Med. (Submitted), 2000.

Barrett, D.H., Doebbeling, B.N., Voelker, M.D., Carney, C.P. Falter, K., Woolson, R.F., and Schwartz, D.A. Post-traumatic Stress Disorder and Physical Health Status among U.S. Military Personnel Serving During the Gulf War Period: A Population-based Study. (Submitted), 2000.

Jones, M.F., Doebbeling, B.N., Woolson, R.F., Clarke, W.R., Hall, D.B., Crumley, T., Barrett, D.H., Falter, K.H., Torner, J.C., Burmeister, L.F., Merchant, J.A., and Schwartz, D.A. Methodologic Issues in a Population-Based Health Survey of Gulf War Veterans. (Submitted), 2000.

Sadler, A.G., Booth, B.M., Cook, B.L., Torner, J.C., and Doebbeling, B.N. The Military Environment: Risk Factors for Women's Nonfatal Physical Assaults. (Submitted), 2000.

Sadler, A.G., Booth, B.M., Cook, B.L., and Doebbeling, B.N. The Military Environment: Factors Associated with Women's Risk of Rape. (Submitted), 2000.

Appendix E. Study Personnel

Principal Investigator:	Bradley Doebbeling, MD, MSc
Co-Investigators:	Joseph Barrash, PhD Donald Black, MD Gwendolyn Ford, MD Kenneth Saag, MD, MSc David Schwartz, MD, MPH Robert Woolson, PhD Thoru Yamada, MD
Study Coordinator:	John Holman, MA
Assistant Research Scientist	Margaret D. Voelker, PhD
Database Manager:	Carrie Franciscus, BS
Physical Examiners:	Dina Janzen, MD Robert Zwicki, DO
Research Assistant:	Megan Adams, BA, BS
Research Assistant (Neurocognitive evaluations):	Amy Schumacher, MS
Student Research Assistants:	Katie Melchert Jane Zingler

Note: Several additional investigators have been regular participants in the study group, making regular contributions to the study and participating out of personal or scientific interest. These include two of our consultants and multiple other investigators: Drs. David Watson, PhD, Psychology; James Torner, PhD, Epidemiology; Caroline Carney, MD, MS, Psychiatry/Internal Medicine; Brian Cook, MD, MS, Psychiatry; Arthur Hartz, MD, PhD, Family Medicine/Health Management and Policy; Toni Tripp-Reimer, PhD, Nursing/Anthropology; Anne Sadler, RN, PhD; Jay Sandlow, MD, Urology; Julia Seng, RN, ARNP, Nursing; Susan Zickmund, PhD, Internal Medicine/Program in Biomedical Ethics.

Appendix F. Data Collection Instruments

1. NEUROPSYCHOLOGICAL BATTERY

Test/Item	Abilities assessed
Background Interview	Academic/neurologic history
WAIS-R Similarities	Verbal intellect
WAIS-R Block Design	Nonverbal intellect, visuoconstruction
WAIS-R Digit Span	Concentration, immediate memory span
WAIS-R Digit Symbol	Nonverbal learning, visuomotor speed
NART-R	Premorbid intelligence
COWA	Expressive language, sustained attention
Rey AVLT	Verbal learning and memory
AVLT-Repeated Delay	Exaggeration
BVRT	Immediate visual, memory, exaggeration
RMT	Verbal memory, visual memory, exaggeration
Stroop Test	Response inhibition, concentration
Trail Making Test	Visual scanning, visuomotor speed, cognitive shifting
Starry Night Test	Reaction time, sustained visual attention
Grooved Pegboard Test	Manual dexterity, visuomotor integrity
MMPI-2	Psychological status, exaggeration

NART-R = National Adult Reading Test-Revised; COWA = MAE Controlled Oral Word Association Test; Rey AVLT = Rey Auditory Verbal Learning Test; BVRT = Benton Visual Retention Test; RMT = Warrington Recognition Memory Test; MMPI-2 = Minnesota Multiphasic Personality Inventory-2.

2. MENTAL HEALTH EXAMINATION

Instrument	How Administered	Assesses
SCID-IV	rater	Axis I disorders
GAS	rater	Global function
BLSQ	self-report	Life Stress
Mississippi Scale	self-report	PTSD symptom severity, effects
SPS	self-report	Social support
Barsky Amplification Scale	self-report	Amplification
ASI	self-report	Amplification; Hypochondriasis
Whiteley Index	self-report	Amplification; Hypochondriasis
MASQ	self-report	Mood and Anxiety
SNAP	self-report	Personality

SCID-IV = Structured Clinical Interview for DSM-IV Non-Patient Version; GAS = Global Assessment Scale; BLSQ = Brief Life Stress Questionnaire; SPS = Social Provisions Scale; MASQ = Mood and Anxiety Symptom Questionnaire; SNAP = Schedule of Nonadaptive and Adaptive Personality

3. PATIENT EVALUATION

Instrument	How Administered	Evaluation
History and Physical form	Clinician	History and Physical
Review of Systems form	Clinician	Review of Systems
Family History form	Clinician	Family History
Disability and Distress Rating	Clinician	Physical Disability and Psychological Distress
SF-36	Self-report	Health Status
Health Utilities Index	Self-report	Health Status, Utility Measure
Dartmouth COOP Charts	Self-report	Health Status, Health Functioning
10 cm. Visual Analog Pain Scale	Self-report	Current Pain
Occupational Exposure questionnaire	Self-report	Occupational Exposure

**Appendix G. Eligible Subjects (based on the study's three *a priori* outcomes)
Potential Subjects for Cognitive Dysfunction Study**

	Symptomatic	Not Symptomatic	Total
Exposed	290	999	1289
Not Exposed	99	1076	1175
Total	389	2075	2464

Potential Subjects for Depression Study

	Symptomatic	Not Symptomatic	Total
Exposed	225	1064	1289
Not Exposed	131	1044	1175
Total	356	2108	2464

Potential Subjects for Fibromyalgia Study

	Symptomatic	Not Symptomatic	Missing	Total
Exposed	300	989		1289
Not Exposed	144	1030	1	1175
Total	444	2019		2464